United States Patent [19]

Bergeron

[11] **4,375,789**

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[54] **FIRST OUT INDICATOR**

[75] Inventor: **Ned A. Bergeron**, Houma, La.

[73] Assignee: **B.W.B. Controls, Inc.**, Houma, La.

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[51] **Int. Cl.**[3] **F15B 13/04**

[52] **U.S. Cl.** **116/70;** 116/112; 116/266; 116/273; 137/553; 137/625.66

[58] **Field of Search** 116/70, 112, 266, 202; 137/553, 525.66

[56] **References Cited**

U.S. PATENT DOCUMENTS

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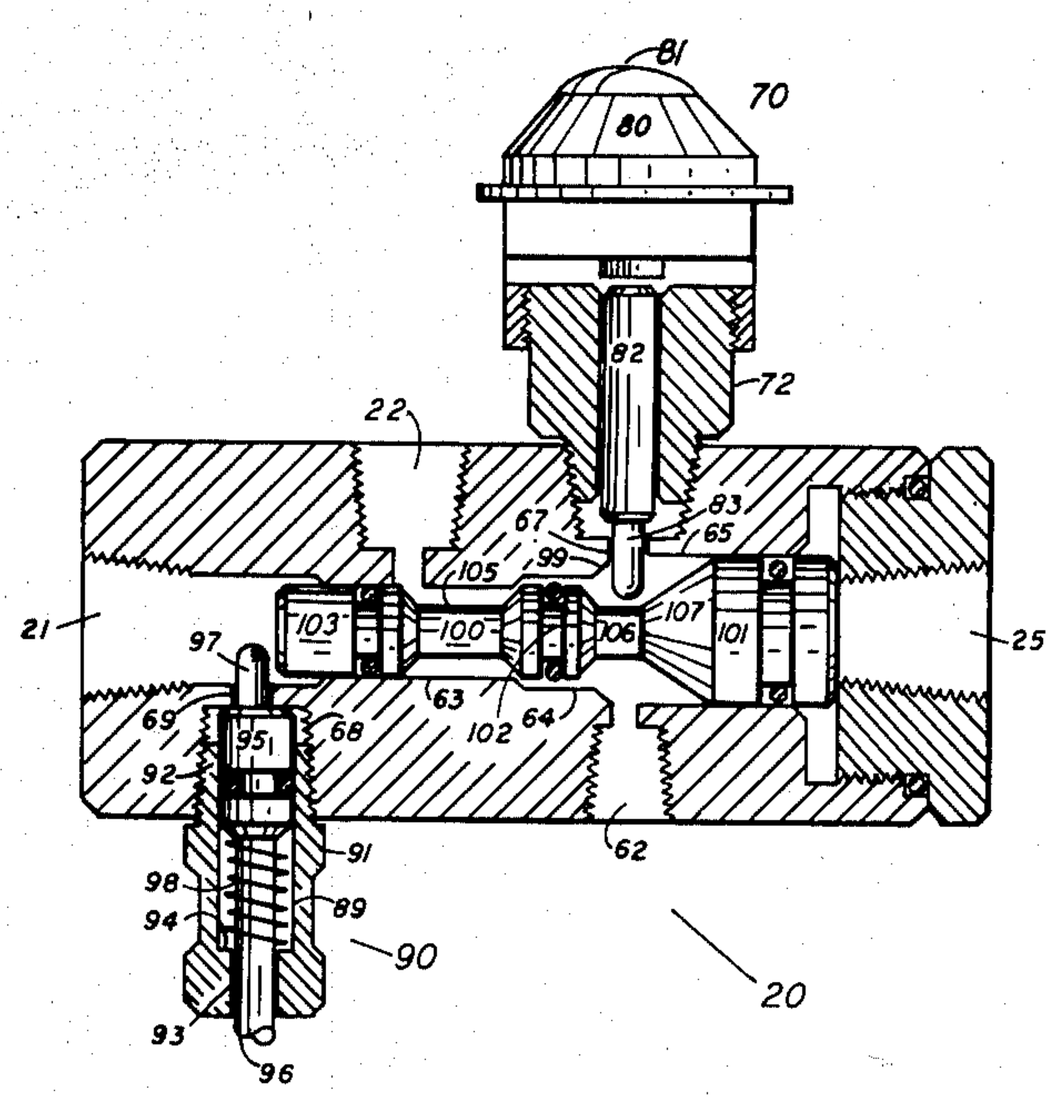
Primary Examiner—Robert I. Smith
Attorney, Agent, or Firm—Bode & Smith

[57] **ABSTRACT**

Control system for indicating which, of a plurality of sensed functions, first malfunctions. The system includes a plurality of series connected devices, each such device includes a shiftable valve which, in one position activates an indicator, and, in another position deactivates said indicator. Signalling connections link the devices such that all indicators, save the one governing the first malfunction, remain in the indicating condition they were in prior to such malfunction occurring.

4 Claims, 3 Drawing Figures



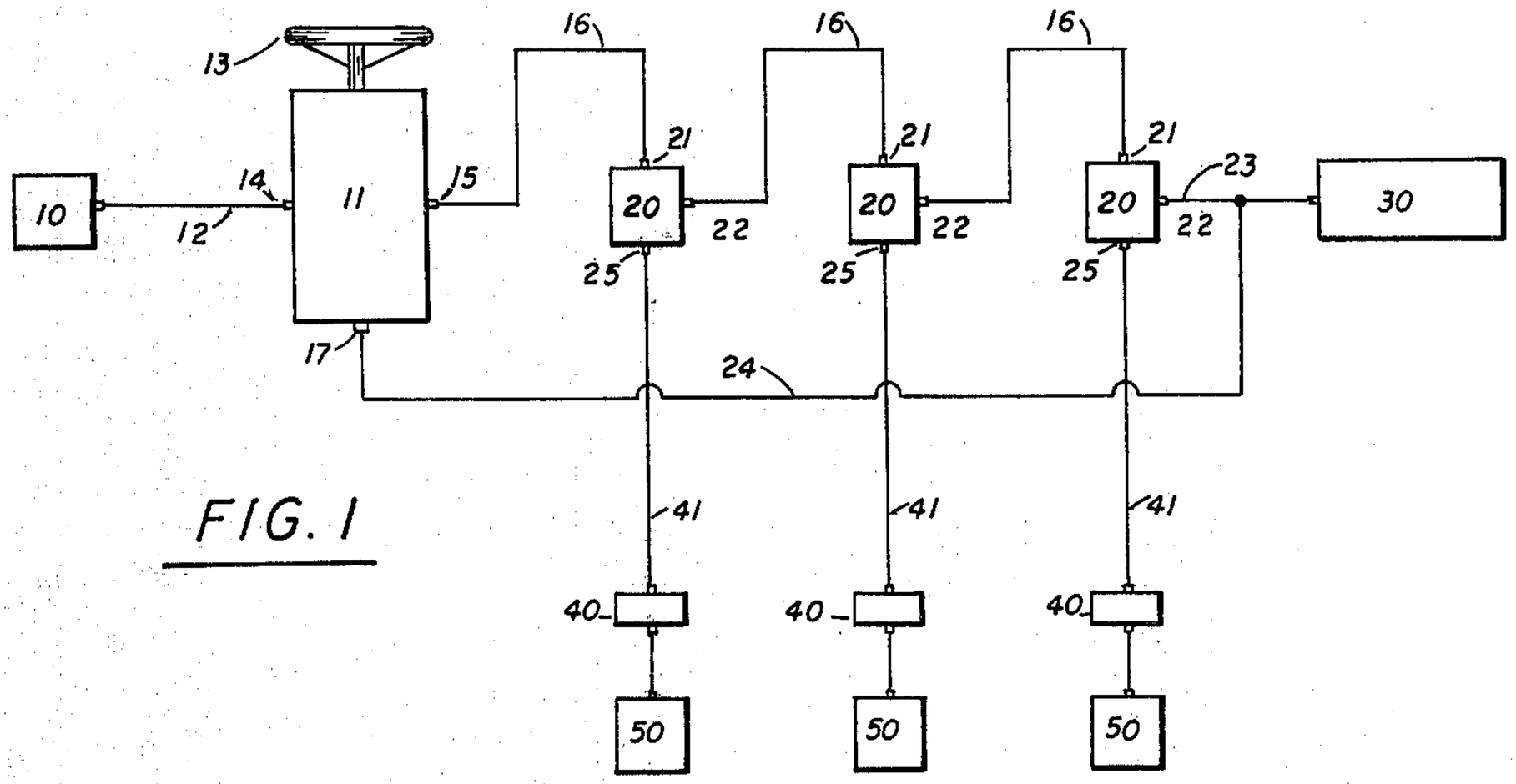

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FIG. 1

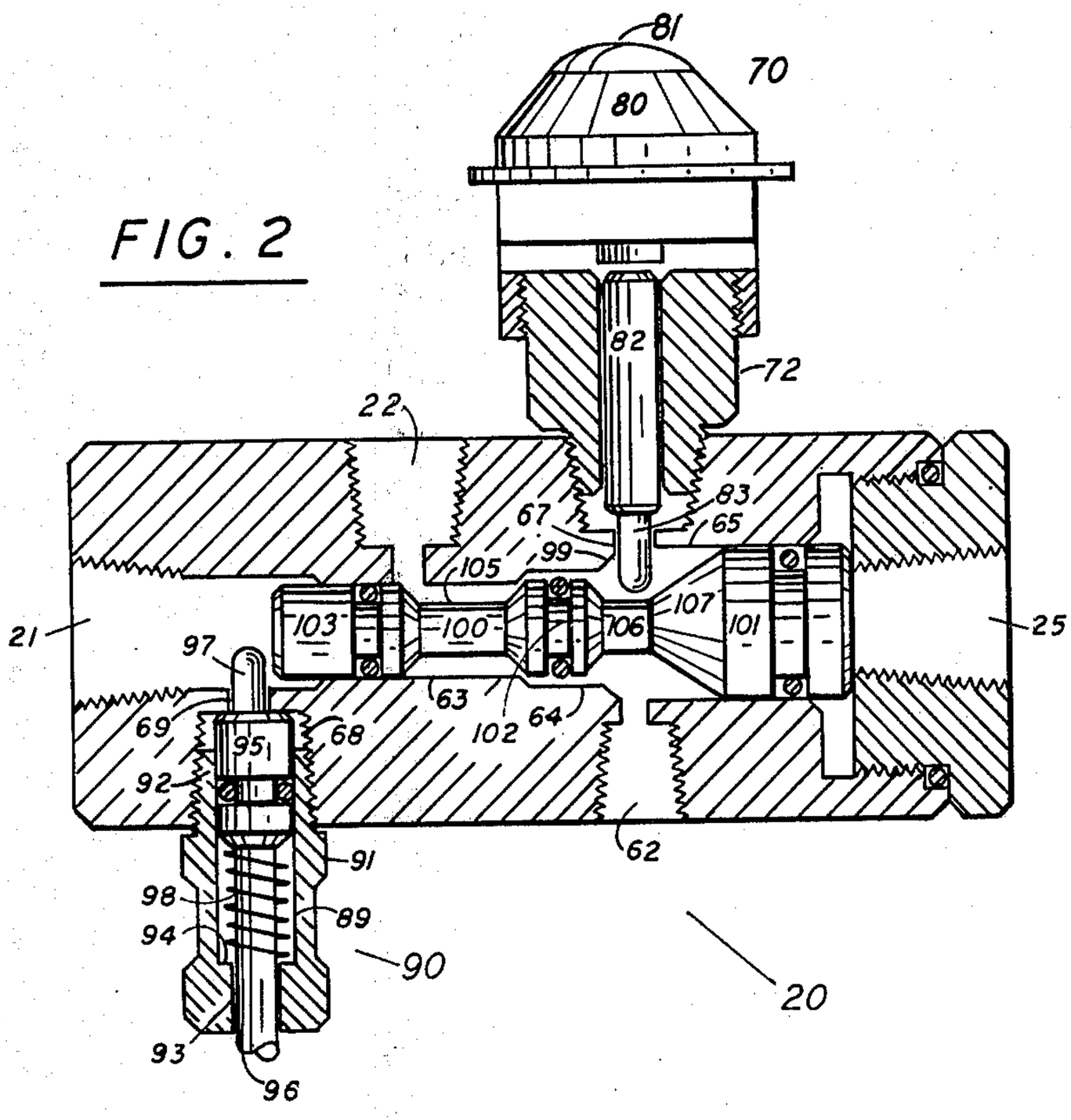
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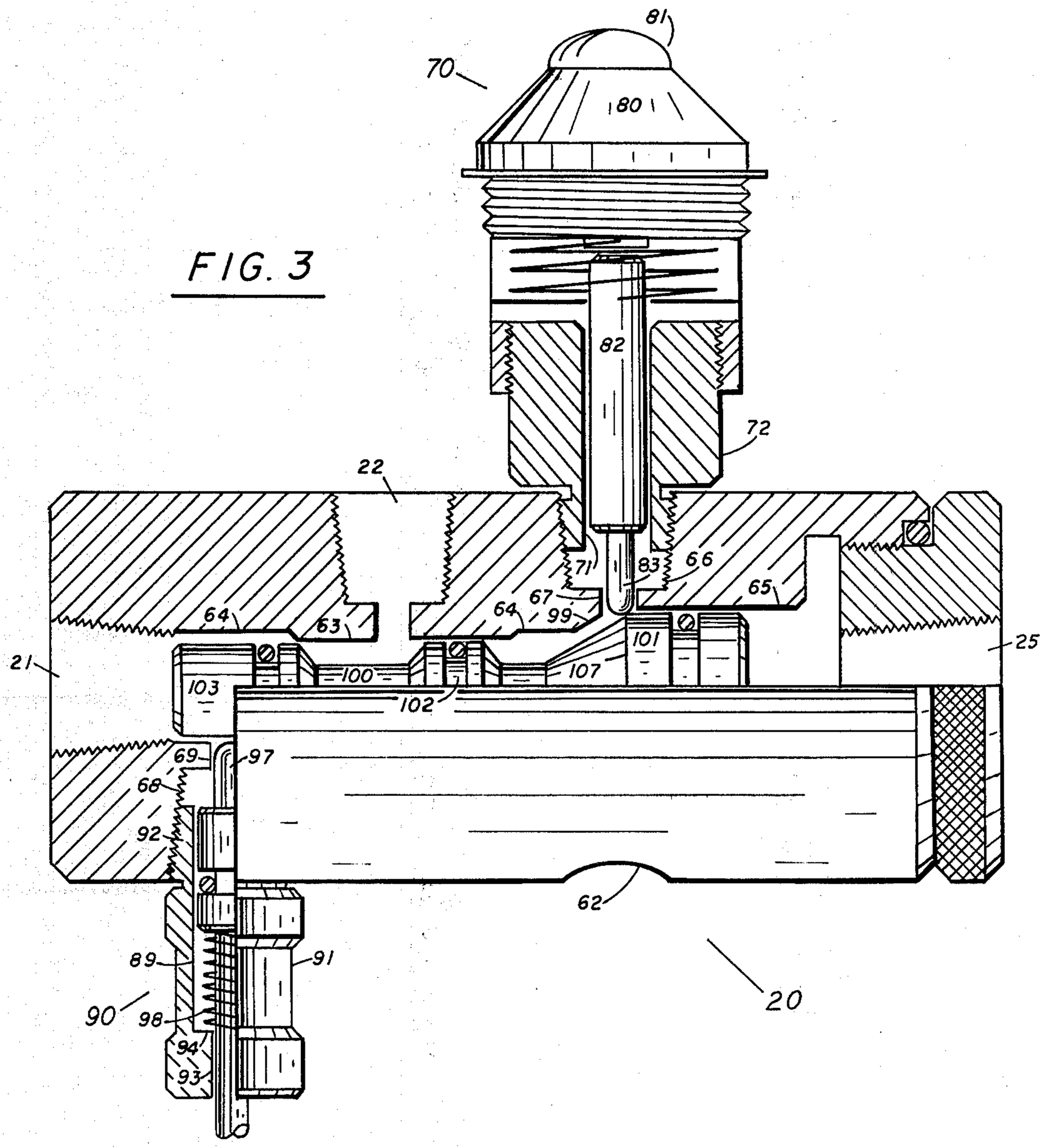
FIG. 2

FIG. 3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FIRST OUT INDICATOR

BACKGROUND OF THE INVENTION

In the production of energy, a particular production site, such as an offshore platform, may require the continuous monitoring of numerous variables. Any one of such variables may, on a malfunction occurring, cause a shutdown of the entire system. Quick detection of the particular malfunction is desirable. The trial and error system is time consuming, and thereby is costly. This invention has as its prime goal the provision of a control system which may be used to monitor a number of variables, yet indicate the site of an initial malfunction.

SUMMARY OF THE INVENTION

A plurality of indicators are series connected intermediate a source of pressurized fluid and the controlled or regulated equipment, such as wellhead valve actuators. Each indicator would also be in communication with a particular monitored device, such as a production line. Such communication may be through an intermediate pilot control. By virtue of the series connection, the output of one indicator leads to the input of the succeeding one. The last of the series would be linked to the regulated equipment, and may be linked to the initial pressurized fluid source. Each indicator includes a shiftable valve which, in one position causes a signal to be emitted indicating operativeness, and, in another position causes a signal to be emitted indicating inoperativeness. On a particular malfunction occurring, pressure would be bled. Supply pressure on the inlet side shifts the valve to the position which causes the inoperativeness signal to be emitted. Such shifting opens a vent which exhausts downstream supply pressure and thereafter shuts off the supply reservoir. The valves in the remaining indicators remain in the position they were in at the time of the initial malfunction. Thus, an operator can readily detect the source of the initial malfunction, make necessary repairs, and reactivate the system.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic of the entire system having a series of indicators;

FIG. **2** is a partial axial section through the indicator of this invention, showing the valve in a position to indicate inoperativeness; and

FIG. **3** is a section similar to that of FIG. **2**, but showing the valve in a position to indicate operativeness.

DESCRIPTION OF A PREFERRED EMBODIMENT

Consider first the schematic of FIG. **1**, depicting the series arrangement. A reservoir, or source of supply, **10**, would supply pressurized fluid through a conduit **12** to supply inlet **14** of control device **11**. Such control device may be of the type generally illustrated by U.S. Pat. Nos. 3,963,050 or 3,877,484, which permits a supply pressure to pass therethrough so long as a sensed pressure is present. Such controls oftentimes, for safety reasons, require manual activation of handle **13** to reactivate the system. Said control device **11** would normally pass supply fluid out supply exit **15** through supply conduit **16** to supply inlet **21** of the first of series connected indicators **20**. Such supply fluid then would normally leave supply exit **22** through supply conduit **16** to the next series connected indicator **20**. The last such indicator would have its exit conduit **23** linked

both to the regulated equipment **30**, which may be a wellhead valve actuator, and by return conduit **24** to sensed pressure inlet **17** of control device **11**. Each indicator **20** also has control or pilot fluid inlet **25** whereby pilot or like control device **40** supplies control fluid from a source not shown, to indicators **20** through conduits **41** so long as the variable being monitored in elements **50** fall within acceptable limits. Elements **50** may be production lines, and the variable may be pressure, for example. Control devices, such as Type "R" pilots manufactured by B.W.B. Controls, Inc., pass a supply pressure so long as a sensed pressure falls within an acceptable range.

Moving now to FIGS. **2** and **3**, which illustrate the indicators **20** of this invention, the former showing the valve in inoperative condition and the latter in an operative state. As earlier mentioned, each indicator includes a fluid supply inlet **21** as well as a control fluid inlet **25**. Further, said indicators possess supply fluid outlet **22** and vent or exhaust **62**. Each of said inlets, outlets and vents communicates with a centrally disposed longitudinal bore. Said bore includes central section **63**, enlarged counter bores **64** positioned opposite section **63**, and greatly enlarged counter bore **65** adjacent control fluid inlet **25**.

Also communicating with the longitudinal bore are two pin carrying members. Signal **70** includes a cylindrical body **72** which has a threaded lug extension **71** which engages a threaded tap **66**. Threadedly mated with said cylindrical body is a signalling member **80**. Such a member, exemplified by a commercially available product sold under the mark WINKIE LIGHT, includes a dual colored, rotatable mask. The particular color apparent under dome **81** is a function of pressure exacted by axially movable piston **82**. Such piston includes a cam-engageable pin **83**, at one end thereof. Piston **82** moves within an axial bore through body portion **72** of signal **70**. Pin **83** may extend through an aperture **67** which connects counter bore **65** and tap **66**.

The other pin carrying member, namely stop **90**, includes a cylindrical housing **91**. This housing also has a threaded lug portion **92** which engages threaded tap **68** of indicator **20**. Said tap **68** communicates with counter bore **64** by virtue of aperture **69**. Stop housing **91** includes an axial bore **89**, which narrows to counter bore **93** at shoulder **94**. Slidable within said housing bore is a piston **95**, carrying a stem **96** on one side, and a pin **97** on the other. Pin **97**, similarly to pin **83**, may extend within the axial bore portion of indicator **20**, through aperture **69**. Piston **95** carries an O-ring for sealing engagement with the wall of bore **89**. Spring **98** urges piston **95** and pin **97** toward the position shown in FIG. **2**.

Slide valve member **100** includes three piston portions, **101**, **102** and **103**, each of which carry an annular O-ring for sealing engagement with bore portions **65** and **63** respectively. Piston **101** is the largest of the three, and rides within enlarged counter bore **65**. Piston **103** rides within bore **63** and the axially extreme counter bore **64**, while piston **102** rides within bore **63** and the centrally disposed counter bore **64**. Said pistons are connected by reduced diameter sections **105** and **106**. Piston **101** also includes an annular or toroidal cam surface **107**. The juncture of counter bore **65** and the centrally disposed portion of counter bore **64** forms a seat at **99**.

OPERATION

Assuming that the entire system is operative, the individual indicators would be in substantially the position of FIG. 3. Supply fluid from reservoir **10** flows through conduit **12**, to and through control **11**. From supply exit **15** of control **11**, supply fluid flows through conduit **16** through inlet **21** of the initial indicator **20**, by piston **103** and out supply exit **22** and on to the supply inlet of the next series connected indicator. From the supply outlet of the last of the indicators, supply fluid would pass through conduit **23** to both the regulated equipment **30**, and to fluid inlet **17** of control **11**. Pressure through such inlet **17** retains a valve not shown in member **11** in such a position as to permit suppy fluid to course through said member. Each indicator would also be receiving control fluid under pressure through inlet **25**, which fluid has passed through other controls **40**. These latter controls permit such control fluid to pass therethrough from a source (not shown) provided that the monitored variable, such as pressure in elements **50**, is wihtin set limits. At such time, said control fluid exerts a pressure against the face of piston **101**, causing cam surface **107** to force pin **83** on piston **82** radially of the indicator housing, whereby such piston causes, in a known manner, a first color, or other signal to be emitted by signalling member **80**. Piston **95** and pin **97** are retained in the position of FIG. **3** by piston **103**.

Assume now that a malfunction, such as a line break occurs in one element **50** of FIG. **1**, say the middle such element. The pressure drop caused by such malfunction would be sensed by control **40**, which would cut off control fluid through conduit **41** to control inlet **25** of the associated indicator **20**. Supply fluid through supply inlet **21** acting primarily against piston **102**, would push slide valve member **100** to the FIG. **2** position whereby radial movement of piston **82** and of pin **83** into counter bore **65** would cause a different signal to be emitted by signalling device **80**. At this time supply fluid from the downstream indicators would be bled through port **62**, since communication is established between supply exit **22** and bleedport **62**. Since the remaining indicators, at this time would be receiving control fluid, retaining their slide valve member in the FIG. **3** arrangement, supply fluid would be bled from the entire system, causing shutdown, of the controlled function of member **30**. Thus all other indicators would remain in their pre-malfunction position, allowing repair personnel to quickly determine the source of the initial malfunction, or first out. Note that stop member **90** may not only indicate the position of its associated slide valve member, but even on the return of control fluid pressure, requires a force radial to bore **63** be exerted, such as a manual force, in order to permit slide valve member **100** to return to the FIG. **3** position. Although only a single embodiment has been described, it should be obvious that numerous modifications can be made by one skilled in the art without departing from the spirit of the invention, the scope of which is limited only by the following claims.

I claim:

1. An indicator comprising:

I. a housing having bore means substantially there through, said housing also including;
  (a) first fluid inlet,
  (b) first fluid outlet,
  (c) second fluid inlet, and
  (d) first fluid exhaust means, said exhaust means including said first fluid outlet and an exhaust port, each of said inlets, outlets and port being in communicating relationship with said bore means;

II. Valve means slidable in said bore means between a first position permitting fluid communication between said first fluid inlet and first fluid outlet, and a second position both preventing such fluid communication as well as permitting fluid communication between said first fluid outlet and said exhaust port; and

III. removable barrier means for blocking movement of said valve means from its said second position to its said first position, said barrier means being removable by fluid pressure in said first inlet and said valve means being movable from said second position to said first position upon sufficient fluid pressure in said second inlet to overcome said fluid pressure in said first inlet.

2. The indicator of claim **1**, further comprising signalling means for indicating the first and second positions of said valve means, in the first position, the signal emitted by said signalling means being a function of both the exertion of said second fluid pressure against one end of said valve means and the exertion of said first fluid pressure against and barrier means, and in the second position, the signal emitted by said signalling means being a function of the loss of said second fluid pressure.

3. The apparatus in claim **2**, wherein said signalling means comprises:

I. a signal body affixed to said indicator housing, a piston member slidable within said signal body and extending partially within said housing bore means, and plural emitting means in said signal body operable as a function of the position of piston member whereby on said piston member occupying a first position, a first signal is emitted and on said piston member occupying a second position, a second signal is emitted; and

II. a cam portion provided said valve means in contactable relation to one end of said signal body piston member, said cam portion adapted to position said signal body piston member between its plural position when said valve means shifts between its two positions.

4. The indicator of claim **1**, wherein said barrier means further comprises:

I. a detent housing engaged with said indicator housing, said detent housing having a central bore with a spring bias detent pin slidable within said detent housing bore and removably extendable at least partially within said indicating housing bore means in the path of said valve means, and removable from said path upon said first fluid pressure being exerted on said detent pin.

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